

## 600W Hall Thruster Qualification Life Test (Hall Qual)

Completed Technology Project (2017 - 2020)



## Project Introduction

The objective of this task is to perform thruster testing at GRC to demonstrate the capability of the BHT-600 sub-Kilowatt Hall Thruster system to support mission lifetimes up to 10,000 hours, 5000 ON/OFF cycle operation while delivering a mission average thrust level of ~37mN at a total Isp of ~1600s. The Hall thruster system would be capable of providing an unprecedented 6-8 km/sec total delta-V. The propulsion system fuel baseline is xenon. An iodine compatible version is being tested at GRC using the more storable (low pressure, solid), higher stored density alternative. Demonstrating lifetime and ON/OFF cycles is the costliest and most schedule intensive activity for system level qualification to move from TRL 5 to TRL 6. Utilizing and validating, through structured testing and government physics based models may lead to an industry wide acceptance of test and modeling based qualification. Plume measurements are part of the proposed test plan and can be used as input into commercial and government spacecraft interaction models. Sub-kW power level Hall thrusters are emerging as the preferred option for a variety of missions involving small satellites. From LEO observation platforms to large constellations intended to provide worldwide internet coverage, adopting a Hall thruster can provide significant system advantages. The extended lifetimes enabled by recent advances put Hall thrusters in direct competition with ion engines for NASA deep space science and exploration missions. As the industry evolves toward highly capable small satellites, the BHT-600 is emerging as an attractive propulsion option. The xenon fueled BHT-600 is a high fidelity TRL-6 engineering model thruster which is supported by a flight demonstrated HCA (BHC-1500) and an engineering model power processing unit (BPU-600c). The combination of excellent performance, wide throttling range in power and Isp, high propellant throughput, have made the BHT-600 trade very favorably against competing EP and non-EP systems. The proposed xenon fueled version of Busek's BHT-600 Hall thruster will directly support the iodine compatible version being developed for NASA-GRC.

## Anticipated Benefits

Demonstrating lifetime and ON/OFF cycles is the costliest and most schedule intensive activity to move system level qualification from TRL 5 to TRL 6. Utilizing tests such as this and validating physics based models may lead to an industry wide acceptance of test and modeling based qualification.



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## Organizational Responsibility

**Responsible Mission Directorate:**

Space Technology Mission Directorate (STMD)

**Lead Center / Facility:**

Glenn Research Center (GRC)

**Responsible Program:**

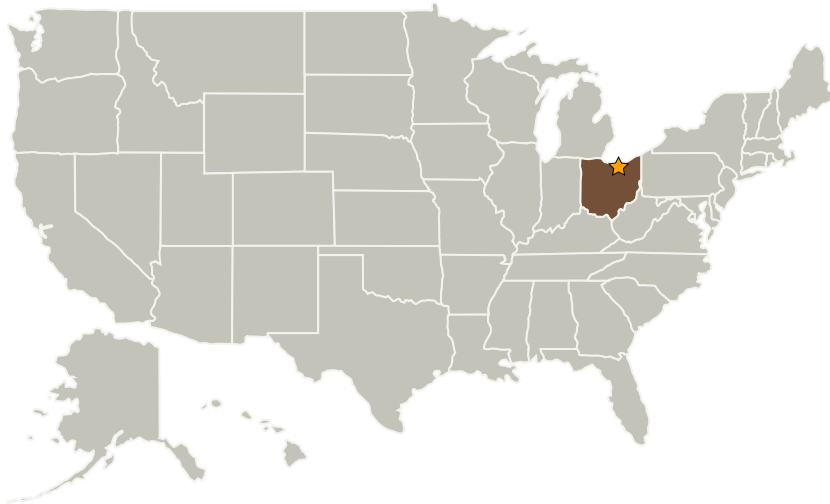
Game Changing Development

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## Primary U.S. Work Locations and Key Partners




Organizations Performing Work	Role	Type	Location
★ Glenn Research Center(GRC)	Lead Organization	NASA Center	Cleveland, Ohio

## Primary U.S. Work Locations

Ohio

## Project Transitions

 **December 2017:** Project Start

## Project Management

**Program Director:**

Mary J Werkheiser

**Program Manager:**

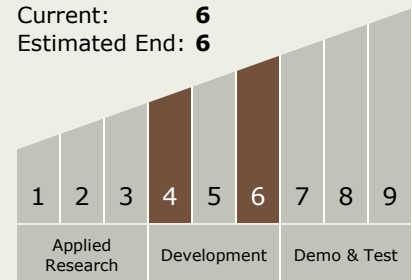
Gary F Meyering

**Principal Investigator:**

Dean P Petters

## Technology Maturity (TRL)

Start: 4  
Current: 6  
Estimated End: 6



## Technology Areas

**Primary:**

- TX03 Aerospace Power and Energy Storage

## Target Destinations

Earth, The Moon, Mars, Others  
Inside the Solar System

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### ✓ June 2020: Closed out

**Closeout Summary:** The objective of this project was to perform thruster testing at GRC to demonstrate the capability of the BHT-600 sub-Kilowatt Hall Thruster system to support mission lifetimes up to 10,000 hours, with 5000 ON/OFF operation cycles. The project was awarded as part of the Space Technology Announcement of Collaborative Opportunity (ACO): NN H17ZOA001K and executed as space act agreement between Busek Inc and NASA Glenn Research Center (GRC). The project received funding for a base period of testing sufficient to complete 5,000 hours of operation with an option for an additional 5,000 hours was eventually not exercised. This project showed that the BHT-600 is capable of delivering a mission average thrust level of ~39 mN at a total Isp of ~1500s. A single thruster system would be capable of providing an unprecedented 6-8 km/sec total delta-V to a small spacecraft with an initial mass of 180 kg. The collected data were also used toward validation of Busek's Hall thruster erosion model, which will be useful for other thrusters operating at higher and lower power levels.